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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/083,756	02/25/2002	Do-Hyung Kim	4591-227	2262

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EXAMINER	
VU, QUANG D	
ART UNIT	**PAPER NUMBER**
2811	

DATE MAILED: 09/25/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/083,756	KIM ET AL.	
	Examiner	Art Unit	
	Quang D Vu	2811	

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on amendment filed on 06/18/03.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-26 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-26 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Election/Restrictions

Applicant's election of group I in Paper No. 4 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)).

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1, 3-4 and 12-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent No. 5,994,201 to Lee in view of US Patent No. 6,231,673 to Maeda.

Regarding claims 1 and 12, Lee (figures 2A-F) teaches a method for forming an oxide layer in an integrated circuit device process, comprising:

forming the pad oxide layer (202) using a thermal oxidation method (column 3, lines 20-22) on a surface of a semiconductor substrate (200).

forming a CVD material layer (206) on the thermal oxide layer (202).

Lee differs in not showing forming a thermal oxide layer and a CVD material layer in the CVD apparatus. However, Maeda (figure 25) teaches conducting processing such as heat treatment, thermal oxidation, and CVD processing (column 15, lines 51-55), a single apparatus,

which reads on a CVD apparatus. It would have been obvious to one having ordinary skill in the art at the time the invention was made to conduct thermal oxide growth and CVC deposition in the same apparatus as taught by Lee because it would reduce the processing time and contamination.

Regarding claim 3, Lee teaches the CVD material layer (206) is formed of a material of silicon oxide.

Regarding claim 4, Lee and Maeda apply to this claim as discussed regarding claim 1 above. Lee teaches forming another CVD polysilicon layer (208) on the CVD material layer (206) in the CVD apparatus.

3. Claims 2, 5 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee in view of Maeda, and further in view of US Patent No. 4,804,633 to Macelwee et al.

Lee and Maeda apply to these claims as discussed regarding claim 1 above.

Regarding claim 2, Lee and Maeda differ in not showing the thermal oxide layer having a thickness of approximately 20 Angstroms to 100 Angstroms. The thickness of the thermal oxide layer is a known variable, which is subject to routine experimentation and optimization. Macelwee et al. show that it is conventional to form pad oxide with thickness of approximately 100 Angstroms (column 3, lines 39-41), which is in the claimed range. It would have been obvious to one having ordinary skill in the art at the time the invention was made for the thermal oxide layer having a thickness of approximately 20 Angstroms to 100 Angstroms, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering

the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

Regarding claim 5, Lee and Maeda differ in not showing growing a thermal oxide layer using oxygen. The oxygen is a known material for growing a thermal oxide layer. Macelwee et al. show that it is conventional to form thermal oxide layer using oxygen (column 3, lines 36-41). It would have been obvious to one having ordinary skill in the art at the time the invention was made for growing a thermal oxide layer comprises using oxygen, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use. In re Leshin, 125 USPQ 416.

Regarding claim 6, Lee and Maeda differ in not showing growing a thermal oxide layer having a temperature of approximately 750^0C to 1000^0C. The temperature of thermal oxide layer is a known variable, which is subject to routine experimentation and optimization. Macelwee et al. show that it is conventional to form thermal oxide layer with temperature of approximately 1000^0C (column 3, lines 36-41), which is in the claimed range. It would have been obvious to one having ordinary skill in the art at the time the invention was made for growing a thermal oxide layer having a temperature of approximately 750^0C to 1000^0C, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

4. Claims 7 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee and Maeda in view of Macelwee et al., and further in view of US Patent No. 6,150,235 to Doong et al.

Lee, Maeda and Macelwee et al. apply to these claims as discussed regarding claims 1-6 above.

Regarding claims 7 and 13, Lee, Maeda and Macelwee et al. further differ in not showing forming a CVD material layer having a temperature of approximately 700^0C to 850^0C. The temperature of oxide layer is a known variable, which is subject to routine experimentation and optimization. Doong et al. show that it is conventional to form oxide layer with temperature of approximately 600^0C to 800^0C (column 4, lines 48-51), which is in the claimed range. It would have been obvious to one having ordinary skill in the art at the time the invention was made for forming a CVD material layer having a temperature of approximately 700^0C to 850^0C, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

5. Claims 8 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee and Maeda in view of Macelwee et al., and further in view of US Patent No. 5,923,998 to Liu.

Lee, Maeda and Macelwee et al. apply to this claim as discussed regarding claims 1-6 above.

Regarding claim 8, Lee teaches the surface of the semiconductor substrate comprises a bottom and a sidewall of a trench formed by etching the substrate to a predetermined depth.

Lee, Maeda and Macelwee et al. further differ in not showing the CVD material layer is formed to a thickness of approximately 50 Angstroms to 400 Angstroms. The thickness of oxide layer is a known variable, which is subject to routine experimentation and optimization. Liu shows that it is conventional to form oxide layer with thickness of approximately 50 Angstroms to 200 Angstroms (column 3, lines 17-20), which is in the claimed range. It would have been obvious to one having ordinary skill in the art at the time the invention was made for the CVC material layer is formed to a thickness of approximately 50 Angstroms to 400 Angstroms, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

Regarding claim 9, Lee teaches the CVD material layer (206) is formed of a material of silicon oxide.

6. Claims 10 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee, Maeda, Macelwee et al. in view of Liu, and further in view of US Patent No. 6,150,235 to Doong et al.

Regarding claims 10 and 14, Lee, Maeda, Macelwee et al., Doong et al. and Liu apply to these claims as discussed regarding claims 1-9 above.

7. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lee, Maeda, Macelwee et al., Liu, US Patent No. 6,180,493 to Chu in view of US Patent No. 6,140,208 to Agahi et al., and further in view of US Patent No. 5,665,633 to Meyer.

Lee, Maeda, Macelwee et al. and Liu apply to this claim as discussed regarding claims 1-9 above.

Lee, Maeda, Macelwee et al. and Liu differ in not showing forming a nitride liner layer on the oxide layer. However, Chu (figures 2A-G) teaches forming a nitride liner layer (214) on the oxide layer (212). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate the teaching of Chu into the method taught by Lee and Maeda because it prevents oxidation on the sidewalls of the trench.

Lee, Maeda, Macelwee et al., Liu and Chu differ in not showing forming a nitride line layer having a thickness of approximately 30 Angstroms to 100 Angstroms. The thickness of nitride liner is a known variable, which is subject to routine experimentation and optimization. Agahi et al. show that it is conventional to form nitride liner with thickness of approximately 55 Angstroms (column 3, lines 30-31), which is in the claimed range. It would have been obvious to one having ordinary skill in the art at the time the invention was made for forming a nitride line layer having a thickness of approximately 30 Angstroms to 100 Angstroms, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

Lee, Maeda, Macelwee et al, Liu, Chu and Agahi et al. differ in not showing forming a trench filling layer having a thickness of approximately 3000 Angstroms to 10,000 Angstroms. The thickness of trench filling layer is a known variable, which is subject to routine experimentation and optimization. Meyer shows that it is conventional to form a trench filling layer of approximately 4000 Angstroms (column 1, lines 32-40), which is in the claimed range. It would have been obvious to one having ordinary skill in the art at the time the invention was

made forming a trench filling layer having a thickness of approximately 3000 Angstroms to 10,000 Angstroms, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

8. Claims 15, 18, 19, 22-23 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent No. 6,180,493 to Chu in view of US Patent No. 6,231,673 to Maeda.

Regarding claims 15 and 22, Chu (figures 2A-G) teaches a method of forming a layer for an integrated circuit device, comprising:

forming a trench (208) in a single silicon substrate (200) by etching;

forming an oxide layer (210) on a surface of the trench (208);

forming a conformal liner material layer (212) on the thermal oxide layer (210); and

forming a nitride liner layer (214) on the conformal liner material layer (212).

forming a trench isolation material (216) on the nitride liner layer (214) to fill the trench (208).

It is inherent that the oxide layer (210) is a thermal oxide layer because the oxide layer is formed by an oxidation process carried out in an oxygen-filled atmosphere at a high temperature (column 4, lines 36-39).

Chu differs in not showing the thermal oxide layer, the liner material layer, and the nitride liner layer are formed in the same chemical vapor deposition (CVD) apparatus. However, Maeda (figure 25) teaches conducting processing such as heat treatment, thermal oxidation, and CVD processing (column 15, lines 51-55), a single apparatus, which reads on a CVD apparatus.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to conduct thermal oxide growth and CVC deposition in the same apparatus as taught by Chu because it would reduce the processing time and contamination.

Regarding claim 18, Chu and Maeda apply to this claim as discussed regarding claim 15 above.

Chu teaches the liner material is made of silicon oxide (column 4, lines 44-45). Chu differs in not showing the liner material layer is made of silicon dioxide. It would have been obvious to one having ordinary skill in the art at the time the invention was made for the liner material layer is silicon dioxide, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use. In re Leshin, 125 USPQ 416.

Regarding claim 19, Chu and Maeda apply to this claim as discussed regarding claim 15 above.

Regarding claim 23, Chu and Maeda apply to this claim as discussed regarding claim 22 above.

Regarding claim 26, Chu teaches the liner material (212) is made of silicon oxide (column 4, lines 44-45).

9. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chu in view of Maeda, and further in view of US Patent No. 4,804,633 to Macelwee et al.

Regarding claim 16, Chu and Maeda apply to this claim as discussed regarding claims 15, 18 and 19 above.

Chu and Maeda differ from the claimed invention by not showing the thermal oxide layer is formed to a thickness of 20 Angstroms to 100 Angstroms. The thickness of the thermal oxide layer is a known variable, which is subject to routine experimentation and optimization. Macelwee et al. show that it is conventional to form pad oxide with thickness of approximately 100 Angstroms (column 3, lines 39-41), which is in the claimed range. It would have been obvious to one having ordinary skill in the art at the time the invention was made for the thermal oxide layer having a thickness of approximately 20 Angstroms to 100 Angstroms, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

10. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chu in view of Maeda, and further in view of US Patent No. 6,174,785 to Parekh et al.

Regarding claim 17, Chu and Maeda apply to this claim as discussed regarding claims 15, 18 and 19 above.

Chu and Maeda differ in not showing the liner material layer having a thickness of 50 Angstroms to 400 Angstroms. The thickness of the oxide liner is a known variable, which is subject to routine experimentation and optimization. Parekh et al. show that it is conventional to form oxide liner with thickness of approximately 100 Angstroms to 200 Angstroms (column 6, lines 21-22), which is in the claimed range. It would have been obvious to one having ordinary skill in the art at the time the invention was made for the liner material layer is formed to a thickness of 50 Angstroms to 400 Angstroms, since it has been held that where the general

conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

11. Claims 20, 21 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chu and Maeda in view of US Patent No. 4,804,633 to Macelwee et al., and further in view of US Patent No. 6,150,235 to Doong et al.

Regarding claims 20 and 25, Chu and Maeda apply to these claims as discussed regarding claims 15, 18-19, 22-23 and 26 above.

Chu and Maeda differ in not showing forming a CVD material layer is carried out using N_2O and SiH_4 as source gases. Chu and Maeda are silent with respect to how the CVD material layer is deposited. It would have been obvious to one having ordinary skill in the art at the time the invention was made for forming a CVD material layer is carried out using N_2O and SiH_4 as source gases, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use. In re Leshin, 125 USPQ 416. It is known in the art as shown for example by US Patent No. 6,074,917 to Chang et al. (column 4, lines 36-49).

Chu teaches forming a thermal oxide layer comprises using oxygen (the oxidation process is carried out in an oxygen-filed atmosphere; column 4, lines 36-37). Chu and Maeda differ in not showing the thermal oxide layer is formed using O_2 at a temperature of approximately 750^0C to 1000^0C. The temperature of thermal oxide layer is a known variable, which is subject to routine experimentation and optimization. Macelwee et al. show that it is conventional to form thermal oxide layer with temperature of approximately 1000^0C (column 3, lines 36-41), which is

in the claimed range. It would have been obvious to one having ordinary skill in the art at the time the invention was made for the thermal oxide layer is formed using O_2 at a temperature of approximately 750^0C to 1000^0C, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

Chu, Maeda and Macelwee et al. further differ in not showing forming a CVD material layer having a temperature of approximately 700^0C to 850^0C. The temperature of oxide layer is a known variable, which is subject to routine experimentation and optimization. Doong et al. show that it is conventional to form oxide layer with temperature of approximately 600^0C to 800^0C (column 4, lines 48-51), which is in the claimed range. It would have been obvious to one having ordinary skill in the art at the time the invention was made for forming a CVD material layer having a temperature of approximately 700^0C to 850^0C, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

Regarding claim 21, Chu, Maeda, Macelwee et al. and Doong et al. apply to this claim as discussed regarding claims 15 and 18-20 above. Chu teaches forming a trench isolation material (216) on the nitride liner layer (214) to fill the trench (208) in the same CVC apparatus.

12. Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chu and Maeda in view of Macelwee et al., and further in view of US Patent No. 6,174,785 to Parekh et al.

Regarding claim 24, Chu, Maeda, Macelwee et al. and Parekh et al. apply to this claim as discussed regarding claims 15-19, 22-23 and 26 above.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Quang D Vu whose telephone number is 703-305-3826. The examiner can normally be reached on Monday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on 703-308-2772. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9306 for regular communications and 703-872-9306 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

qv
August 29, 2003

Tom Thomas

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